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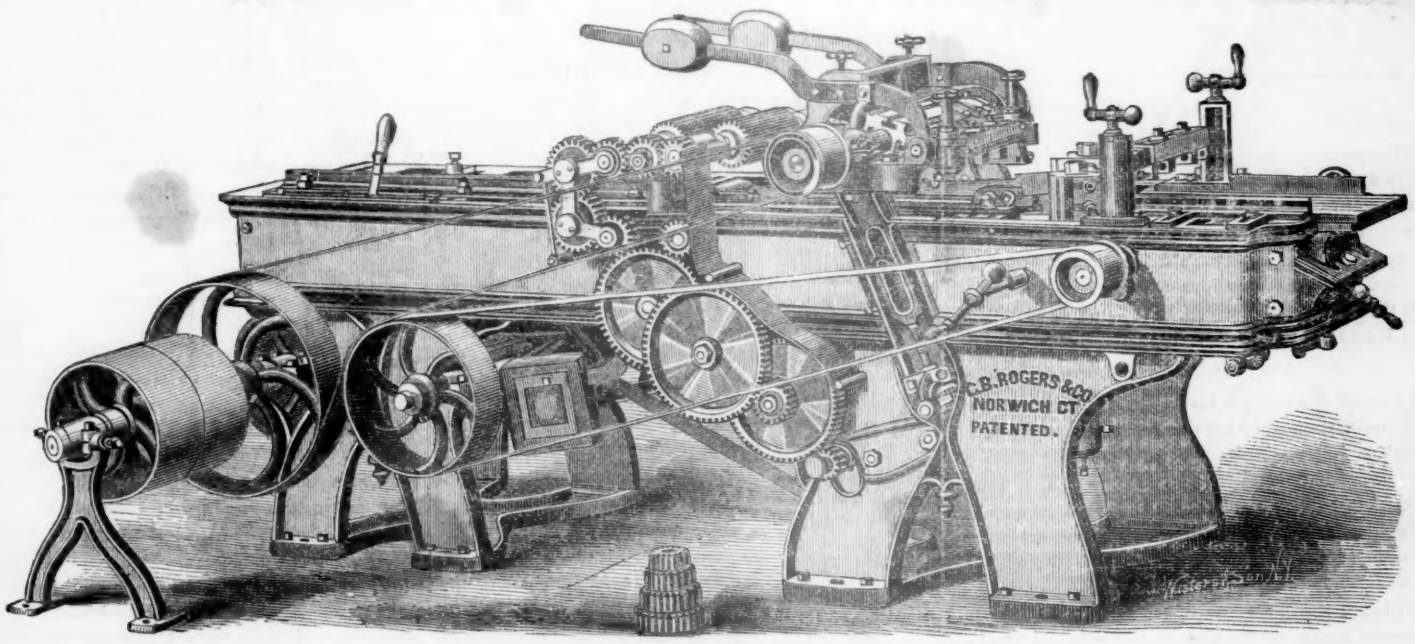
Four Side Molding Machine.

The accompanying engraving illustrates a molding machine, on which every variety of moldings, from the largest and most complicated, down to the smallest, can be made with the greatest rapidity and accuracy.

The upper cylinder or cutter-head, slotted on four sides, is 10 to 14 inches long, of the best gun metal, on a 1¼ inch cast steel arbor driven at both ends by 4½ inch diameter, 5 inch face pulleys.

The side spindles are 1⅝ inch cast-steel and run in patent self oiling steps. Both spindles are made to raise and lower, or set on any angle, and will retain the desired angle while being adjusted to or from the work. The side-heads are slotted on four sides, and one spindle is made to receive a circular saw 8 inches diameter. The under cylinder is driven by a 4½ inch diameter 5 inch face pulley, and is adjusted to the work by a crank. Between the under cylinder and end of machine is a circular saw arbor, upon which the saw, 7 or 8 inches in diameter, can be adjusted endwise with the arbor, and by a crank, up to the work. The angular end piece gibbed into the frame, is adjustable with a screw up to the depth of under cylinder-cut. A sliding bed or table is gibbed into the top of this angular piece and forms a table for circular saw, and bed for under cylinder; the whole of which will slide out of the way for the adjustment of cutters, etc. The four feed-rolls are 4 inches diameter and geared together by patent Expansion Gears, and weighted by patent Weighting Attachment. The yoke of upper feed roll shafts can be slipped off, leaving the shafts free to change the feed-rolls. It has five changes of feed, ranging from 15 to 41 feet per minute. The change is effected by changing the pinion gear on the feed-shaft, leaving the feed-belt undisturbed. There are no clutches, the rolls being driven by a friction feed.

It is also provided with a weighted adjustiable pressure-bar, with yielding attachment, for making two lines of mouldings at once; and [illegible] appliances for holding work in its place.



FOUR SIDE MOLDING MACHINE.

A few of the many kinds of work this machine is capable of doing are: Double Surfacing and Matching to 10 inch, planing and matching staves, planing siding, sticking stair rail, ormoulding from 10 inch by 5 inch, down to the smallest. It will work a single moulding on four sides, and cut out a square angular corner piece saving a strip of lumber large enough to make a moulding.

It will also work two lines of mouldings, one of which can be separated by the saw as they are made, thereby finishing three lines of moulding at the same time, and will work all three on four sides at the same operation, each one of which will be finished as well as any machine will finish a single moulding. It is capable of working 50,000 feet of moulding per day. The tight and loose pulleys are 12 inches in diameter, 6 inface, and should make 900 revolutions per minute, giving heads 4000. Weight without box, 3,350 lbs.

Further particulars can be had on application to C B. Rogers & Co., 109 Liberty street N. Y.

The East River Bridge.—We are glad to learn that work on the East R[illegible]ion Bridge has commenced, and that in good earnest. It is, moreover, gratifying to learn that the services of Colonel W. H. Paine—throughout the late war was one of the most distinguished engineers attached to the headquarters staff of the army of the Potomac—have been secured, and that in association with Col. Roebling, the engineer-in-chief, he has already entered upon the discharge of the duties incumbent upon him. The surveys for the bridge are already completed upon the Brooklyn side, and also the triangulations across the river. Work is now progressing rapidly on the New York side. The work of putting in the foundations for the piers, etc., will soon commence; the timber for their construction having been already contracted for. With the combination of eminent engineering talent employed, there can be no question as regards the successful and rapid prosecution of the work.

Chemical Repertory.--No. 14.

SEPTEMBER 16, 1869.

American Chemical News.

ON THE CONSERVATION OF FORCE.

BY PROFESSOR H. F. WALLING, OF LAFAYETTE COLLEGE.

Read to the AMERICAN ASSOCIATION at Salem, Mass., August, 1869.

(*Abstract, sanctioned and revised by Professor* WALLING *himself*.—H. W.)

[Let not *any* of our readers pass over the following subject as too abstract, or not sufficiently "practical." In the present day, often, what is deemed too profound for plain men, and therefore rashly called "speculative" by some, to-day, will to-morrow become the fundamental rule of all true practice. In other words what is to-day the geometry and algebra of science, will to-morrow inevitably become its arithmetic. This to-morrow it is *our* duty to hasten, if we can. Our readers are by this time sufficiently familiar with our determination to make this Journal the instrument of elevating the practical sciences within its scope, to the true position they should occupy in this land. They may rest assured that these so-called abstract scientific principles are the true basis of rational practice and progress; a position which it rests with us, as occasion may permit, to demonstrate and illustrate. First, however, it is necessary to arrive at clear understandings, or rather strict definitions, of these fundamental ideas; and it is most devoutly to be hoped that those who may not see these things in the same light as the learned gentleman whose paper we here condense, will do us and our readers the kindness to impart their own views to us. They will thereby enable each one to employ his own judgment upon these fundamental doctrines of Mechanical Science; upon which it must be obvious now to all that the Science of Heat, or Thermics, and, through this, the practical sciences of heating and illumination, essentially depend. The unprejudiced common sense of mankind is, after all, the only criterion applicable, in this, as in all other mere differences in the scientific interpretation of facts: but, first of all it is essential to the application of this criterion that the utmost possible *precision as to the meanings of words* should be arrived at, or rather started with. Without such a starting point, it is scarcely possible to make useful comparisons of ideas or pursue parallel trains of thought. A mathematical strictness of definition must be the corner-stone. When this is attained, almost all is attained. Sane minds cannot then rationally differ as to conclusions from accepted facts, and half the controversies which have agitated the Scientific World might thus have been obviated.—H. W.]

ABSTRACT.

Professor WALLING, in his paper, after alluding to the high estimation in which the law of "conservation of force" is justly held by scientific men, and to the admirable modern investigations upon which it is now thought to be fully established; remarked that serious difficulties are encountered whenever we attempt to state the law clearly, and to demonstrate its applicability to facts. He attributed these difficulties to a want of precision in the definitions of matter and force, and a failure to recognize the *independent* existence of force.

The usual enunciation of the conservation theory is the statement that the aggregate amount of energy in the universe is unchangeable in quantity.

DEFINITION OF ENERGY, OR VIS VIVA.

Energy, it may be said, is the power which a moving body has, of *performing work*, or in other words, of causing bodies to move against opposing forces. The most simple mode of performing work is the lifting of weights, and the usual unit by which it is estimated is the foot-pound, or that amount of energy which will raise one pound of matter, one foot in vertical height, against the opposing force of gravity. The amount of energy which a moving body possesses, depends entirely upon its velocity, whatever may be the direction or cause of its motion. The actual energy of moving bodies is sometimes called *vis viva*.

VIS VIVA IS *not* CONSERVED.

If we suppose that all energy is conserved, it follows that there can be no diminution of velocity in any part of the physical universe without a corresponding increase in some other part, or any increase without a corresponding diminution elsewhere.

To show that this statement is untenable, the action of the pendulum was cited. When raised and allowed to fall, it gradually acquires energy, until it reaches its lowest point, when it gradually loses all its acquired energy; this process being repeated alternately as the pendulum rises and falls. Now it cannot be shown that the energy which appears and disappears is drawn from and imparted to any other material body.

So with the motions of the heavenly bodies which approach and recede from each other in accordance with the laws of gravitation. So also with the minute atoms of bodies which are now known not to be in contact with each other, but to approach and recede from each other in continually recurring cycles, whose duration however, is almost inconceivably brief. Even the transmission of force from body to body by a pull or a push is accomplished by propagated disturbances of this kind. Professor PEIRCE has shown in his "Treatise on "Sound," that "were the sun and earth connected by "an iron bar, no less than 1074 days, or nearly three "years, must elapse before a force applied at the sun "could reach the earth."

Every physical phenomenon therefore indicates beyond a doubt that the total energy of the universe, instead of being constant, is essentially variable. It is only because the periods of loss and gain are, in atomic motions, so excessively brief that their energy *appears* to be constant, for the reason that we can only estimate the *mean* energy, which *is really* constant. But even these atomic energies are subject to important variations, as when solids change to liquids, liquids to gases, etc That is, energy appears or disappears, but the corresponding process in the reverse direction is indefinitely postponed.

"POTENTIAL ENERGY."

How then can we say that force is conserved? The usual mode of reconciling the facts with the theory is by introducing the phrase "potential energy," to indicate that energy which has disappeared in a cyclical motion, being that which the *position* of the body makes it possible or certain to acquire in the future.

Thus when the pendulum is at its highest point it has no *actual* energy, for its motion is entirely gone. But it is so situated that it has an available space to fall through, in which gravity may again act upon it to impart actual energy. It is therefore said to possess "*potential energy*," that is, it has a possible energy in the future.

ENERGY OF CHEMICAL MOLECULES.

In the same way, chemical atoms or molecules, for example, those of carbon or hydrogen, have a "potential energy," due to their possible union or "falling together" with atoms of oxygen, and when this falling together takes place the actual energy of combustion is manifested.

If now, as in the cases of the pendulum and the planets, *all* the actual energy of combustion could be expended in effecting the separation of the combined atoms, it is quite evident that an analogous result would be produced; that is, the energy which has been developed by the union would be just sufficient to again effect a disunion or decomposition of the carbonic acid or water resulting from the combustion, restoring the component atoms to their original condition. Radiation, conduction etc., of course prevent any practical realization of this dissociating process, and the combined atoms maintain their union until they are separated by an energy which is superior to that with which they unite.

MODIFIED STATEMENT OF THE CONSERVATION-THEORY.

In general, the maximum potential energy of cyclical motions, like those of the pendulum, the planets, and the revolving or vibrating atoms, is equal to their maximum actual energy; and since whatever is taken from one is added to the other, *the sum of actual and potential energies is a constant quantity*, and this is the way in which the theory of conservation of energy is maintained.

OBJECTIONS.

The phrase "potential energy," was introduced by Professor RANKINE, and it is doubtless very convenient in practical mechanics, but it is considered objectionable by Sir JOHN HERSCHEL, inasmuch as "it goes to sub-"stitute a truism for the announcement of a great dyn-"amical fact." It certainly possesses an antithetical meaning to actual energy, which is fatal to the idea of conservation. The chemist does not talk of potential hydrogen when that subtle element disappears from his notice. On the contrary, he improves his instruments, increases his vigilance, and perhaps like GRAHAM finds it in alloy with palladium.

THE INDEPENDENT EXISTENCE OF FORCE.

All difficulty is removed if we admit the existence of force as a distinct entity in an *independent condition*, as has been recently advocated by such men as FARADAY, WATERSTON, CROLL, and Sir JOHN HERSCHEL.

The force which becomes associated with matter is then supposed to be drawn from an external, universal store, and restored to it when dissociated. This hypothesis, as Professor WALLING has shown in previous papers, will afford a very simple explanation of gravitation; namely, by the mutual interception of opposite forces, by each pair of atoms; and also an adequate reason for NEWTON'S third law of action and reaction. That is, for every addition to or abstraction from the force of a body in one direction, some other body undergoes an exactly equal addition to or abstraction from its force in the opposite direction.

SUMMARY.

The practical value of the theory of conservation of energy, then, depends; First, upon the constancy of the mean energy of atomic motions, and second, upon the equality of the simultaneous association and dissociation of force with matter; or upon the equality of action and reaction.

DISCUSSION.

Dr. P. H. VAN DER WEYDE of New York, objected to the doctrine of independent force, claiming that force was nothing but "matter in motion." He also objected to the term "potential energy" and said that RANKINE had injured the cause of science by its introduction. Forces are mutually convertible, and when force disappears in one form it is converted into another. For example the light and heat of the sun are converted into mechanical force, etc. During his remarks,

Professor HENRY of the Smithsonian Institution, inquired of him what would become of the energy of a vibration of heat or of sound, which should be sufficiently powerful to break a pane of glass in passing through it, and

Professor NORTON, of Yale, inquired what form of energy the motion of the pendulum would be converted into, when it disappears at the highest point of its path. To these questions no reply was made.

Professor PEIRCE, of the United States Coast Survey, remarked that whatever might be said against the use of the word potential, as applied to forces, mathematicians would continue to use it. It was not RANKINE, moreover, but GAUSS, who introduced the expression, and it had been made use of as a mathematical function by other great mathematicians.

[BALFOUR STEWART, in his Treatise on Heat, attributes the conception of *potential energy* as applied in Practical Mechanics, to Sir WM. THOMSON, but Prof. WALLING has pointed out to me that RANKINE in replying to a criticism of HERSCHEL, has reclaimed this conception for himself, a reclamation which stands as yet undisputed.

Professor WALLING however admits that Professor PEIRCE is strictly right in citing the previous use of a mathematical expression similar in its nature, especially by GAUSS, in his profound magnetical investigations.

H. W.]

The Observations of the Mattoon Expedition; on the Great Eclipse of 1869.

Read to the American Association, at Salem.

(Communicated from the Dudley Observatory, at Albany.)

[By favor of Professor Hough, Director of the Dudley Observatory, we are enabled to present a very full and striking narrative from his own pen and that of Prof. David Murray, of Rutgers College, of the great Eclipse, as observed in its totality and partiality. It is unfortunate, nevertheless, that the wonderful developments of the Mattoon observers were unaccompanied by the spectroscope. We have heard, through the public prints, of the discovery of new elements in the flames which emanate from the chromosphere, or at least of new spectral lines; but as yet have nothing reliable.* It is to be hoped, if any lines were really discovered in the spectrum of the chromosphere, in addition to the six or seven which were observed during the Eclipse of last year in Europe, that American Journals of Science may be selected as the medium of convection of such American discoveries to the world. To return; the article we give below is not excelled in graphic interest, even by Arago's famous account of the total Eclipse of 1842, in France. We are obliged to omit the introductory description of the astronomical apparatus used.—H. W.]

The night proceeding the day of the Eclipse was one of unusual anxiety to the observers, from the fact that about six o'clock it began to rain, and continued almost without intermission until 11 P. M. In order to learn the worst we went to the telegraph offices and asked for weather reports from west and east. At nearly all the stations from which reports had been received, extending from Omaha to Cincinnati, it was rainy or cloudy. These reports led us to expect a storm extending over a large area of teritory. And it was presumed that it would be a day or two in passing over. But fortunately our prognostics were in error, for at 11 o'clock P. M. the rain ceased, and stars began to make their appearance. The morning of the 7th was perfectly clear with not a cloud to be seen, and it so continued during the whole day and subsequent night. It was one of those rare days but seldom seen in this climate; the atmospheric disturbance being at a minimum.

One hour before the begining of the Eclipse, observations were made on the solar spots, and their position and magnitude mapped on a diagram prepared for the purpose. As the time drew near for the first contact of the moon's limb, each observer examined carefully the region where the moon was expected, to see whether it would be visible before contact with the solar disk. The closest scrutiny of five observers failed to discover it.

At 10 seconds before the true contact of the limbs, a lunar mountain, distant 8 or 10 degrees north of the contact point, plunged into the solar disk and was recorded on the chronograph. The true contact of the limbs was well observed by all and at nearly the same instant. The moon's limb, instead of appearing round, as it should, was nearly flat and a little notched, showing a mountainous region. As the Eclipse advanced, observations were made by means of the micrometer and chronograph for measuring the relative position of the two bodies. When the sun was about one half eclipsed, a red band of light was seen surrounding the limb of the moon over the solar disk. Later, during the progress of the phenomenon, tails of light were seen projecting out tangent to the moon's limb and extending 15 or 20 degrees along the edge.

As the crescent of solar light grew less and less, every eye was intently watching for an unusual appearance. Nearly a minute before totality, we saw with wonder a red flame suddenly shoot out from the upper edge of of the moon, and shortly after, the remarkable and beautiful phenomenon of Bailly's beads. The slender crescent of light was suddenly broken up into numerous globules, resembling drops of water flowing together, or a string of beads. One observer compared it to a chain of sausages of unequal lengths.

This peculiar breaking up of the solar crescent was noticed by Bailly in 1836. But during subsequent eclipses it has not generally been seen. This fact has led some of the ablest astronomers to doubt its reality, believing it to be an optical illusion.

At Mattoon, the appearance was distinctly seen by all the observers, and its duration recorded on the chronograph by Mr. Swift and myself. That the phenomenon is real we have no doubt. It is well known that the limb of the moon is exceedingly rough and jagged, with mountains projecting to a great height. Now it is reasonable to suppose that when this mountainous limb of the moon cuts off the slender crescent of light it must be more or less broken up into sections, depending on the irregularities of the surface and the position of the observer. We are more strengthened in this opinion, since previous to the first contact Mr. Swift saw five mountain peaks on the moon, and he reported the beads the most conspicuous in the region towards this part of the lunar disk.

The duration of Bailly's beads was accurately recorded on the chronograph by Mr. Swift and myself, and found to be five and one-half seconds. This is the first exact record ever made for the duration of the phenomenon.

As the light grew less and less, suddenly the sun seemed to pass under the black disk of the moon, producing a feeling of chilliness. Now was seen in all its splendor the large red protuberance sitting on the edge of the moon, and appearing very much like a great ship under full sail. Farther to the left was another, nearly as large, with two bent rays, somewhat resembling the antlers of a deer. Five others, not quite as large, were seen on different parts of the disk, all of a deep red color.

After looking with astonishment for a few seconds, we proceeded to measure with the micrometer the height and position of the largest flame. But just at the critical moment, fortunately or unfortunately, one of the hand rods for moving the telescope came off, and it was necessary to remove the eye from the tube to fix it. On looking up one of the grandest spectacles met the eye of which it is possible to conceive. Surrounding the dark body of the moon was a crown of of light with rays shooting out in five great sheaths, to a distance equal to the sun's diameter, or nearly a million of miles. For a time everything else was forgotten, and we gazed for eight or ten seconds with astonishment, akin to awe, at this magnificent spectacle. No painting can represent it, and no pen can describe it. It is one of those sights which must be seen to be appreciated. But we soon realized that precious moments were slipping away. The telescope was again brought in position, and the height of the large protuberance measured, and found to be 0 2′ 45″, or more than 70,000 miles, 150,000 at the base.

While still gazing, a ray of light suddenly flashed out and the total Eclipse of August 7th was over.

The duration of totality, according to the chronograph records, was two minutes and forty-two seconds. The large protuberance, however, remained visible for five minutes and five seconds after the sun had appeared, or, as Mr. Swift reports, until it was apparently lifted up by the advancing crescent of solar light.

Stars Visible.

Previous to the beginning of the eclipse, we set up a number of light wooden rods, indicating the direction of stars and planets. Professor Twining and Mr. Marshall succeeded in seeing Saturn eight minutes before, and Venus four minutes before, totality. During the totality, Mercury, Venus, Mars, Saturn, and a number of bright stars were visible to the naked eye.

Temperature.

Observations made by Professor Smith, with a thermometer exposed to the direct rays of the sun, showed a variation of 42 degrees during the progress of the eclipse.

The observations of Mr. House, with a thermometer placed in the shade, showed a variation of 13 degrees.

PHYSICAL PHENOMENA.

Professor David Murray, at my request, prepared the paper on the physical phenomena, which is herewith appended.

The peculiar phenomena which have attracted so much attention in Solar Eclipses, are only visible during the brief period of totality. This, in the present case, only extended through two minutes and forty-three seconds. The difficulty of observing them lies in this exceeding brevity, and in the fact that, no matter how much the observer may have studied the experiences of others, the phenomena come upon him as a complete surprise. The moment the last ray of light disappears with the extinguishment of Bailly's Beads, there burste upon him a vision so marvellously beautiful, so startling by its novelty, that his self-possession and self-control desert him, and leave him for an instant a helpless gazer. As soon as he can collect his thoughts and tries to marshal them into order, he will find especially two phenomena of notable interest.

1. THE CORONA.

In immediate contact with the solar disc it appears as a clear silvery light, as bright as the brightest part of an aurora, and somewhat resembling it in consistency. Farther out it appears streaked with pencils radiating in the direction of the centre. These rays are more especially noticeable at five points of the circumference, two of them pointing upwards and outwards, and three having a general downward direction. These prongs could be traced through a distance, even exceeding the diameter of the sun, and near one of them was visible a curved mass of light, in shape resembling the petal of a flower. On the upper edge of the disc was plainly seen an arch of light, parallel with the edge, and within the boundary of the corona.

It should be stated that the phenomenon of the corona is best observed with the naked eye, and cannot be included within the field of any ordinary telescope. Our party are indebted to the observations of Mr. Bostwick, of Mattoon, and General Keifer, of Springfield, Ohio, for the best configuration of the corona.

The commonly received explanation of the corona has attributed it to an atmosphere surrounding the sun, which was illuminated by the light of the sun in the same way that our atmosphere is illuminated in twilight. This will undoubtedly explain the luminosity found nearest the disc—but it can hardly be received as satisfactory in regard to the luminous prongs which extend out to such a great distance. It must be remembered that these prongs projected a distance greater than the whole diameter of the sun, and must have reached an altitude, if they belonged to the sun, of at least a million of miles. This is, of course, beyond all possibility, and the idea of the whole phenomena being of a solar-atmospheric origin is untenable. Equally untenable must be the idea that it is a solar aurora, because an aurora supposes an atmospheric medium, in which it exhibits itself.

The impression which was firmly made upon my mind by witnessing it, was that in some way, the interstriated part at least, was formed in the earth's atmosphere.

2. RED PROTUBERANCES.

The second phenomenon attracting attention was that of the sudden appearance of a number of protuberances of various shape and magnitude, which projected beyond the black disc of the moon, and were of a bright rosy red color. We saw six or eight in all. It must be remembered that these were of immense size. The largest was not less than 70,000 miles in altitude. They seemed to have a cloudy consistency, and the form of some of them forbade the idea that they could have been either solid or liquid. These protuberances are seen in all total eclipses, but in no two are they in the same place or of the same form. They are thus shown to be of a changeable and transitory character. This was really all that could certainly be known about them, until the application of the spectroscope to celestial bodies gave us a new road to a knowledge of them. By means of this we are able to distinguish a solid body from a gaseous, a self-luminous from a reflective body, and, even more, to determine with certainty the very elements composing the incandescent body. This mode of investigation, used first in the total eclipse of 1868, and still more in that of the recent eclipse, has revealed to us that the red protuberances are mainly a mass of incandescent hydrogen gas. The thought is overpowering. Here are vast accumulations of blazing matter reaching to a height of fifty to one hundred thousand miles. What convulsions in the matter of the surface of our sun does this view of it reveal!

That the spots which are seen on the surface of the sun will finally be proved to be identical with the protuberances I venture to predict.

3. FLOATING BODIES.

A few moments before totality, and during that period, nearly all the telescopic observers at our station noticed faint whitish bodies floating past their glasses. Professor Hough saw three, Mr. Swift four or five, Mr. Simons five or six; Mr. House as many, and I saw four at least. At the time they made no impression on my mind. I thought of thistle down, or some other winged seed. Others thought of midges which had been awaked by the darkness: others of swallows. But when we came to compare our observations and our conjectures, we found to our surprise that all these floating bodies had one direction, viz., from the northwest downward toward the southeast; and it seemed therefore impossible to explain them on any of the hypotheses which had been started.

The idea that they were meteoric is perhaps more plausible, and it is strengthened by the fact that the time nearly corresponded to the August period of meteoric showers.

4. EXTERNAL PHENOMENA.

No one who has not seen the phenomenon of a total eclipse can appreciate fully the grandeur of the occasion. As the light, ray by ray, is cut off, a strange and ghastly darkness comes down upon us; not like the darkness of night, but a violet colored darkness, which makes the faces of our neighbors turn ashy pale, and gives to the landscape the hues which it takes in a stereoscopic picture. I cannot better describe the appearances which strike an intelligent eye-observer than in the words of President Hill, who, declining the use of all instruments, devoted himself to noting the external phenomena. He reports the results of his observations as follows:

"During the total eclipse this afternoon, I was in the open field near a small barn, about 1,000 feet west and 550 feet south of your station. According to your request, I herewith give you a memorandum of what I noticed. This memorandum has been twice read to a

*We have since received from Professor Young of Dartmouth College, an abstract of his important papers, which we give below. He describes nine bright lines in the protuberance-spectra. H W.

party of five gentlemen who were with me, and they agree, after full discussion, in every statement.

"A cow grazing in the field became uneasy at five o'clock, and started for home at 5h. and 6m. Soon after a hen gathered her brood under her wings. Swallows were skimming the ground. About two minutes before the total obscuration about seventy cocks and hens went to roost in the barn. A flock of birds flew southward in a hurried and confused manner after the darkness became total. Soon after the reappearance of the sun the chickens came from under the hen, then the fowls came down from their roosts, and the cocks which had crowed occasionally all the afternoon, took it up by general consent and crowed vigorously.

"No other animals were near us. No plants sensitive to light were in the field, and it was not until after the eclipse was over that I discovered Cassia in an adjoining field. Some of us thought there was a slight deposit of dew upon the grass, but others failed to perceive it.

"Venus appeared a minute or two before the total obscuration, and remained visible for several minutes after the reappearance of the sun. At the instant of total obscuration, Mercury, Arcturus and Vega appeared. Even Arcturus was of a silvery whithness. Arcturus remained visible some seconds after the total phase had passed. We looked sharply for Capella, Procyon, Castor and Pollux, Regulus, and Altair, and also looked less carefully for Saturn, Antares, Spica, and Mars, but we had nothing but our general recollection of the stars to guide us as to the direction in which to look, and we saw nothing either with the naked eye or our opera glasses, beyond the two planets and two stars already mentioned. At the instant of total obscuration one or two of us had a feeling that we were seeing half a dozen stars bursting into sight at once, but we could only find the two.

"The approach of the deep violet shadow in the air from the W. N. W., a little to the right of the sun, and its receding in the opposite quarter, was much slower and more majestic and beautiful than we had been led to expect. The gradual diminution of light during the eclipse had revealed the presence of faint cirro-stratus clouds in the horizon of what appeared both before and after the eclipse, a cloudless sky. The transition from penumbra to umbra, although rapid, did not seem absolutely instantaneous. It was a sweeping upward and eastward of the dense violet shadow. This shadow then stretched from the W. N. W. to the E. S. Eastern horizon, while in the transverse direction it did not reach the horizon by six or eight degrees, and the low arch beneath was full of a deep orange twilight. No difference was observed between the height of these arches. The transition from the orange yellow of the northern and southern horizon to the dusky violet of the zenith during the total phase was at an altitude of 12 or 15 degrees, and then the violet seemed darker than in the zenith; as though two broad dark arches ran one on each side the zenith from west northwest to east southeast.

"The corona appeared to us a white ring of 4 or 5 min. breadth, with white rings 30 to 35 min. in length, one of which on the right hand upper limb was curved. No change was observed in the corona during the total phase, except that one of us thought there was a tremulous flashing at the instant before the reappearance of the sun.

"A crimson cloud on the lower limb was particularly brilliant. One on the left limb was brilliant at the beginning, and one on the right limb at the end of the total phase."

It is almost unnecessary to add anything to this graphic description of Dr. HILL. A lady told me that the evening primroses in her garden, at the coming on of the Eclipse, opened their petals as at the approach of evening. The owner of an unruly cow told us that she was kept in a pasture adjoining a cornfield, and she was in the habit of jumping out of her pasture into the cornfield at night. True to her instinct, after the total Eclipse she was found enjoying herself among the corn. During the most exciting period of the phenomena, General KEIFER saw a countryman going at full speed across the field, who said he was going to see what his chickens were doing. He soon returned in a state of intense disgust, declaring that his chickens scratched away during the whole time as if nothing had happened.

Such are the principal phenomena attending this rare and wonderful event. If we could have prolonged the duration to fifteen minutes, we would have bought it at any sacrifice. Oh, if we could have had only time to have sketched, and measured, and studied those wondrous revelations, life would have seemed complete. As it was, it seemed so aggravating, so unsatisfactory, that if another had been visible in California, or South America, or Africa, we would feel full ready to start for it, to complete what was left undone It has been a most serious difficulty in obtaining valuable observations on total Eclipses of the sun that the observers must of necessity be inexperienced, and feel only prepared to make satisfactory observations when the opportunity has passed forever.

Professor C. A. YOUNG, of Dartmouth College, gave papers on his new method of observing contacts by the spectroscope, and also on the spectrum of the solar prominences and corona, etc. The spectroscope furnishes the means of a very accurate observation of the instant of first contact in the following manner: Let an image of the sun, about two inches in diameter, be thrown upon the slit. Bring to the centre of the slit, and perpendicular to it, the point of the limb where the contact is to take place. The spectrum will then be half bright and half dusky, divided by a longitudinal line of demarkation; most of the dark lines will extend clear across both portions of the spectrum alike, but the spectrum of the chromosphere will be seen in the C line as a *needle of scarlet light* extending a little way into the dusky spectrum from the extremity of the dark line in the brilliant portion. As the moon approaches, this red needle will be gradually shortened and will finally disappear at the instant of contact, the C line then becoming exactly like its neighbors. The same method of observation of course might be used with the F line, or any other line of the chromosphere spectrum, but the C line is by far the easiest to observe. At Burlington, Iowa, the time of contact determined in this manner was about five seconds earlier than that of any of the other observations, but agreed within one-third of a second with that obtained from measurements of the photographs.

Special attention was paid to the question whether the moon has any atmosphere; the results were wholly negative, under circumstances where a refraction of one quarter of a second would have been clearly perceptible.

During the totality the following nine bright lines were seen in the spectrum of the prominences—the numbers refer to the scale of KIRCHHOFF—viz: (1) C, (2) 1017.5, (3) 1250 plus or minus 20, (4) 1350 plus or minus 20, (5) 1474, (6) F, (7) 2602 plus or minus 2, (8) 2796, and (9) h. Of these all but the 2d, 3rd, 4th, 5th, and 7th are the well known hydrogen lines; the 2d is the well known but mysterious line above D.

The line 1474 is just below E, and coincides *exactly* with a small line marked as *iron* on KIRCHOFF's and ANGSTROM's maps. It had been previously discovered by Professor YOUNG in July. It turns out also to coincide very closely if it is not (as is much more probable) absolutely identical with a line recently discovered by Professor WINLOCK, of Cambridge, in the spectrum of the aurora borealis. (It is hardly conceivable that *iron* really exists as vapor in the Aurora Borealis. Can this line indicate some new gaseous element which occluded in ordinary iron, causes this line to appear in the spectrum of the spark between iron electrodes, and yet exists independently in our higher atmosphere?) The two faint lines Nos. 3 and 4 also coincide closely with two other lines reported by him.

This line 1474 and probably the two fainter ones 2 and 3 belong to the spectrum of the *corona*, not that of the prominences.

The corona showed besides these bright lines a faint continuous spectrum without any dark lines. The light of this was polarized strongly in a plane passing through the sun, but as suggested by Professor PICKERING, this polarization may arise from the refraction of light through the five prisms that produced the dispersion of the colors.

Professor YOUNG's papers were remarked upon by Professor PEIRCE and Dr. GOULD in a very complimentary manner, especially the first. The new method of observing contacts seems likely to prove of value in the observations of the coming transit of Venus.

THE USE OF THE THERMOMETER TO DETERMINE THE PERIOD OF SOLAR ROTATION. BY PLINY EARLE CHASE

Read in full before the AMERICAN ASSOCIATION, at Salem, Mass.

(*Abstract, communicated by the author.*)

[So far as we know, we have the exclusive privilege of communicating, in an authentic form, the substance of Professor CHASE's two important communications. Though the abstracts with which he has favored us are brief enough to be rather tantalizing, we are nevertheless thankful "for small favors."

No one can fail, however, to be impressed with the masterly conciseness of Professor CHASE's abstracts, and with surprise at the amount of information that can be conveyed in a few words.—H. W.]

Professor HENRY's experiments on the temperature of the solar disc, showed that the spots are cooler than the brighter portions of the photosphere, and the centre is warmer than the rim. These evidences of difference in calorific power have been confirmed by subsequent observers, and SCHWABE, HENSHALL and KIRKWOOD, by a study of sun spots and the variations of solar magnetism, have sought for indications of fixed points, or meridians, on the sun. If the sun is a variable star, any permanent differences in superficial structure, however masked by the irregular disturbances to which the spots are usually attributed, may perhaps be accompanied by regularly recurring differences of temperature, which should be manifested by the thermometer.

The seven years hourly thermometric observations at St. Helena (1840–7) were examined in various ways, in order to discover any traces they might furnish of cycles approximating to the supposed period of solar rotation. After testing, by the method of least squares, various assumed intervals between the limits of 25 and 29 days, the pointings were so decided and uniform, that all the observations were arranged in accordance with a hypothetical period of 27 1-14 days. The annual, semi-annual, and quarterly groupings, all confirmed the hypothesis that this was a normal interval, and the belief was still further strengthened by various comparisons with observations at Philadelphia, extending over a period of 44 years (1825–69).

If we then assume 27 1-14 days for the synodical rotation of the sun, the time of its sidereal rotation is about 25.065 days. This is somewhat greater than the estimates of SPORER (24.6244) and CARRINGTON (24.9711), but nearly accordant with the more recent estimate of FAYE (25.07472). Mr. CHASE proposes to continue the investigation by a discussion of observations at other stations.

PLANETARY INFLUENCE ON RAINFALL AND TEMPERATURE. BY PLINY EARLE CHASE.

Read in full before the AMERICAN ASSOCIATION, at Salem, Mass.

(*Abstract, communicated by the author.*)

The author has recently undertaken, for the Coast Survey, some discussions of the meteorological influences of the moon. An examination of the records which have been kept at the Pennsylvania Hospital, in Philadelphia, for forty-four years, confirmed the conclusions of LOOMIS and others that cloudiness, rainfall, and temperature, are each, to some degree, controlled by the lunar phases. The "establishments," or local influences which modify the results at different stations, often occasioning an entire opposition of curves, especially on opposite sides of large bodies of water, were also clearly shown. There were marked evidences of such establishments, due not only to position but also to the season of the year, occasioning contrasts between the summer and winter curves, and resemblances between the vernal and autumnal curves.

These results, together with a certain degree of opposition between the lunar curves of rainfall and temperature, seemed to indicate a partial dependence of the temperature upon the tidal currents in the atmosphere. If this hypothesis was correct, it seemed probable that some of the planets, especially Jupiter, should furnish corroborative indications. The observations, both of rainfall and of temperature, were therefore arranged successively in accordance with the positions of Jupiter, Venus, Neptune, and Mercury. The arrangement resulted in the production of consistent curves, varying with the varying distances of the several planets, and with their positions relative to the sun. In comparing these curves an opposition was apparent between those of rainfall and temperature, which was more strongly marked than that which had been previously noticed in the lunar curves. It seems unreasonable to attribute the temperature-fluctuations to varying planetary radiation; but it is easy to understand that any influence which tends so to disturb the atmosphere, as to produce a northerly wind, should depress the temperature and increase precipitation, while one which tends to produce a south wind, increases both the temperature and the evaporation.

[Professor EDWARD C. PICKERING, of Boston, communicated a paper on Polariscopic Examination of the Eclipse corona, which is unsurpassed in importance, when we consider the source from which it comes.

Prof. PICKERING has given me the following condensed account of his work. It speaks for itself.—H. W.]

ON THE QUESTION OF THE POLARIZATION OF THE LIGHT FROM THE CORONA IN THE LATE ECLIPSE. BY PROFESSOR EDW. C. PICKERING, OF BOSTON.

Read to the AMERICAN ASSOCIATION, at Salem.

(*Abstract, communicated by the author.*)

In order to observe the degree of polarization of the corona during the late eclipse, I prepared an ARAGO'S polariscope, which consists of a tube closed at one end by a plate of quartz, and at the other by a double image prism of Iceland spar. Looking at any object through the latter we see two images, which when the light is polarized assume complementary tints.

If, as is generally supposed, the corona is polarized in planes passing through the sun's centre, its two images would be colored in such a way that every part would be complementary to that at right angles to it. Thus the top and bottom being blue, the sides would be yellow, while in the second image these colors would be reversed. In reality, however, both images were precisely alike and pure white, but one was on a yellow, the other on a blue background. Hence the corona was unpolarized, but the sky adjoining it was polarized in a plane independent of the position of the sun, since its color was the same on all sides of the latter. This curious effect may be explained by assuming that the earth outside of the shadow acted as an independent source of light, and thus caused polarization in a plane perpendicular to the horizon. This may have given rise to the impression that the corona itself was polarized, as with some of the instruments heretofore used, this mistake might easily be made. As specular and not diffuse reflection is necessary to produce polarization, we cannot conclude that the corona is self-luminous; although this view is rendered probable by observations with the spectroscope, and also by the consideration that if a part of the sun, it would receive many thousand times as much heat per square mile as the earth.

ON THE GEOLOGY OF VENEZUELA. BY DR. R. P. STEVENS.

Read in full before the AMERICAN ASSOCIATION, at Salem, Mass.

(*Abstract, communicated by the author.*)

[Unless we call emphatic attention to the following communication, its claims to interest might possibly escape due consideration. The modesty of the author has prevented his relating the fact that it has been his rare privilege to be the first geologist to visit, in a measure to rediscover, a gold field that has made, while yet unknown to civilized mankind, scarcely less "noise in the world" than the still unknown Ophir of King Solomon. This communication, in fact, gives us the first scientific knowledge, and confirmation of the substantial basis, of the fable of the Golden City of Sir WALTER RALEIGH.

Dr. STEVENS'S detailed reports, which we have had the opportunity to read, show this new gold field to constitute one of the most extraordinary *foci* of genesis or concentration of native gold and gold veins yet known to mankind; and we can scarce hold in doubt now that *El Dorado* was not altogether a myth. This is a development which concerns History, not less than Science.—H. W.]

Since the publications of Baron von HUMBOLDT, nothing has been contributed to the Geology of the southeastern portion of Venezuela. In his grouping of the mountain systems of South America, he groups the entire mountain series of all Guayana into one system, and calls it the Parimi system. Its rocks are all gneiss or granite, and crystalline, according to his description.

Our examination of a large portion of the northern mountains shows the presence of other rocks, such as schists of various kinds, talcose rock, limestone, and itacolumite. A section across the trend of the Imitaca Range, at right angles, exhibits for the first fifty miles only crystalline rocks. At San Maria, the culminating point of this range, it falls off suddenly on the southward full 900 feet, to the plains of Cumé. Hornblende schists, with interstratified veins of quartz, and bands of syenite and granite, with talcose, chloritic and silicious schists, then obtain for two day's journey, until we reach the Valley of the Yuruari river, where we find limestone, itacolumite, and greater frequency of talcose rock. After crossing the Yuruari, we first enter the gold-fields of the country.

Gold veins occur in brecciated and other slates, which are but little changed from the sedimentary and fossiliferous condition. These slates appear to be changed in places into talcose rock, and then auriferous veins are more abundant. The more silicious portions are changed into porphyroid rock, and dioritic rock is frequent.

The best known portion of this gold-field is the Valleys of Mocupio and Iguana. The whole country south of the Imitaca may be called auriferous, for gold is found in all the streams, and on the savanna. In the Mocupio gold is found:

1st. In the beds of streams, in sands and gravel.

2nd. In placer deposits, under cover of earth, clays, and gravel.

3rd. In red earth, within a few feet of the surface. This is often very rich. A nugget weighing fifteen pounds was found in it.

4th. In conglomerate of recent formation.

The geographical area which is auriferous is very great, reaching through the English, Dutch, and French Guianas, and through all of Venezuelian Guayana.

It should be called the "PARIMI GOLD FIELD."

A New Mineral—Durangite.

Some months since Mr. Jos. Bennett left at this office, for examination, a mineral which he had obtained from the vicinity of the steam-tin deposit of Durango, Mexico. We made a brief mention of its reception, and handed the specimen to Mr. Henry G. Hanks, of the firm Falkenau & Hanks, chemists, of this city, for further examination. Mr. H. finding the mineral quite new and interesting in character, forwarded a portion of the same to Prof. Geo. J. Brush, of the Shieffield Scientific School, of Yale College, for more particular examination and analysis. Mr. H. has just received a letter from the professor, accompanied by a proof sheet impression of an article which he has prepared for the September number of the *American Journal of Science* from which it appears that the Durango specimen is a new and most interesting mineral, which the professor has named—after the locality where it was found—Durangite.

The mineral is of a bright orange red, the crystals having a rhombic aspect; streak, cream yellow; luster, vitreous; cleavag, distinct in two directions; crystallizations, monoclinic; hardness 5; specific gravity, 3.95—4.03. The small quantity of which could be used for the test, did not allow a full and complete quantitative determination. Direct duplicate estimations, however, were obtained of every constituent except fluorine. This last element was found to exist in such considerable quantity, that the fluohydric acid evolved, in attacking the mineral by sulphuric acid, etched the glass with great readiness and distinctness. The following results were obtained by analysis. No. 1 in the wet way, by sulphuric acid:

Arsenic acid	55.10;	Quantity of oxygen	19.16
Allumina	20.60;	" "	9.63
Ferric oxide	4.78;	" "	1.44
Manganous oxide ..	1·30;	" "	0.38
Soda	11.66;	" "	3.01
Lithia	0.81;	" "	0.42
Fluorine	undetermined.		

84.33

Analysis No. 2, made in the dry way, by fusion with carbonate of soda; dissolved in water, acidulated with chlorhydric acid, gave: Arsenic acid 53.22; alumina, 20.09; ferric oxide, 5.06; mangenous oxide, 1.28. The low amount of arsenic acid by this determination, it was thought, might be due to the fact that the soda fusion was made over a gas blast-lamp, with the possibility that a portion of the arsenic acid might have been reduced to arsenious acid, and volatilized; or possibly to other accidental causes. The small quantity of mineral would not allow of a repetition of this analysis.

An analysis, No. 3, was made, qualitative quantitative, in which only the alkalies were estimated. The results of this was: Soda, 11.86; lithia, 0.70—agreeing very closely with No. 1. The alkalies examined with the spectroscope showed only the lines of sodium and lithium.

The composition and oxygen ratio (nearly 1 : 3 : 5). says the professor, "suggest an *analogy* between the new mineral and amblygonite, a fluo-phosphate of alumina, lithia and soda;" but he thinks the results given are sufficient to demonstrate it to be a new mineral, and, as he thinks, the only observed native fluo-arseniate.

The Professor, in his private note, says: "It is one of the most interesting minerals, chemically speaking that I have ever investigated; and I have enjoyed the study of it exceedingly.

Mr. Hanks has sent, through the Mexican Consul, for a considerable quantity of the mineral, which he hopes soon to receive, and a portion of which he will forward to Professor B. for further examination.

The study of the crrystallography of the mineral has been taken up by Prof. John Blake, who will give a preliminary note on his observation in the September number of the *Journal of Science*, which will soon be received in this city, and to we would refer the reader for the entire article from which we have taken the liberty to collate the above—*Sci. Press.*

A Revolution in Steam Engines.

The Jersey City *Times* has a description of a machine, now in operation in that city, which is destined to work a revolution in one department of mechanical industry—namely, a new steam engine, which, one-quarter of the weight, and occupying one-quarter of the space required for an ordinary ten-horse engine, will give the same power, with twenty five per cent. less fuel.

This little machine sets at defiance all preconceived notions on the subject, Its motive power is all contained within the circumference of a broad, stout wheel, about three feet in diameter, revolving in a hollow shaft, which receives the steam, delivers it alternately into two opposite reciprocal cylinders, each fixed between the center and periphery. The power thereof, instead of being at the center, presents the singular anomaly of being at the circumference, or in other words, the true center of power is at the periphery of the wheel.

To use a most familiar simile, the wheel is like the hand or drum of a squirrel cage in which two squirrels were consentaneously—one in the usual position, the other in the opposite, but with his head down, and with a motion similar to that of a fly walking on the ceiling—both, of course, in continually reversing position as the wheel turns. It is an application of the simple principle by which, as any one can see, a grindstone may easily be turned by placing the hand upon its surface, while only with considerable muscular exertion a man's hand grasping the shaft can produce the same motion.

The inventor, Mr. Ruset, a Frenchman, residing at Communipaw until quite recently, where he was well known as the author and patentee of several useful minor inventions. The *Times* says it is expected that a stock company will be formed immediately for the manufacture of the Ruset Engine, whose value for all uses requiring lightness of construction, combined with economy of fuel, may be seen by the simple statement that it will give ten-horse power with no more fuel than would be required in a caloric engine of two-horse power, occupying one-fourth of the space, and at a much less cost. And one important feature is that the same engine can be used either to attain a high rate of speed or to do heavy hoisting.

The "Blue Cup" of the Candle Flame.—E. W. Hilgard on "Luminous Flames," in *Silliman's Journal*, says:

"The part performed by the blue cup, viz., that of a self-heating retort with walls impervious to oxygen, in which dry distillation is accomplished; its theoretical import, as the counterpart of the luminous portion, where the same gases are burnt with evolution of light, render the neglect with which it has been treated doubly surprising. That it is totally distinct from the outer veil is rapidly perceived when the eye is protected from being dazzled by means of a screen of the shape and size of the luminous hollow cone. The veil is then seen surrounding the blue cup as well as the higher portions of the flame, and is thus proved to be nothing more than a zone of glowing gas; which of course, however, cannot be strictly defined from the luminous envelope, the oxidation being a gradually progressive one, from the highly luminous central portion to that brownish, semi-transparent zone of transition, where the carbonic oxide, burning simultaneously with hydrogen, fails to produce its characteristic blue tint because of the excessive temperature existing there."

Petroleum News.

We collate the following items from the *Tidioute Journal* of September 2d.

Oil has ranged for the week ending August 26th as follows. The price given is free on board cars at this point:

August 27th for bls. of 42 gal.			$6.35
" 28th,	"	"	5.30
" 30th,	"	"	5.30
" 31st,	"	"	5.25
Sept. 1st,	"	"	5.30
" 2nd,	"	"	5.30

The shipments were as follows:

	bbls.
63 cars, Empire Line, containing	5.357
3 cars, Fisher Brothers, containing	284
Barreled Oil	79
Distilate 646, Representing Crude	808
Total	6,528

Amount of oil in tank at Tidioute Sept. 2:

	bbls.
Amount last report	34,178
Production	7,700
Total	41,878
Shipment as Above	6,528
In tank at this point	35,350
At Hickory	2,500
Grand Total	38,850

On the Miles farm the following condition of the wells to date:

Collins & Co. No. 1, producing....30
Collins & Co. No. 2, producing....15
Crowell, producing....10
Coe, Smutz & Co. No. 1, producing....20
" " No. 2, down 175 feet.
Hoffman well, No. 1, is producing....15
Several new wells nearly ready to commence drilling.

On the Beatty farm:

Beatty No. 1 pumping....10
" No. 3 new, producing....25
Goodrich's No. 1 pumping....20
" No. 2 down 200 feet.
Shaw & Durkee about testing.

Our own immediate neighborhood continues to pour out the oleageneous richness as heretofore. Great activity is manifested on the newly discovered teritory. The O'Leary well continues to pump at the rate of 80 bbls., and Fisher No. 2, is about ready to drill.

On the H. Allen track adjoining, Fisher Brothers have taken a ten acre lease and will soon begin its development.

On the New York and Allegheny track adjoining, Mr. Parshall has two wells which will be finished this week, and two other rigs going up.

On the R. C. Scott farm, Captain Goodrich is progressing favorably. Several leases have been given within the week, to be operated at once, and great activity is visible.

The laying of the pipes from Beatyville to the river is being actively pushed, oil will soon be run direct to White Oak, instead of being hauled as now.

On the Jamison farm, No 1 has gone to a depth of over 500 feet, and no signs of oil rock yet. The Pearse well is being drilled deeper, the second sand rock oil having played out. The Fisher well, which may be classed as No. 3, has found another rock and is pumping at the rate of about 6 barrels. Messrs. Clark & Hague have not yet commenced to drill.

The Tionesta *Republican* reports a well on Ross Run as flowing oil and water, and about being tested, so look-out for double leaded leaders again.

Oxy-Sulphide of Carbon.—This gas has recently been discovered by Thau. It is composed of one atom of oxygen, and one atom of sulphur, and may be regarded as carbonic acid in which one atom of oxygen is replaced by one atom of sulphur. It is formed when not too dilute sulphuric acid acts upon sulpho-cyanide of of potassium, and must be freed from hydrocyanidn acid vapor or water, and sulphide of carbon, that are simultaneously produced. This newly discovered gas appears to be widely disseminaten in nature, but as it is so easily by water into carbonic acid, and sulphurated hydrogen, it frequently escapes detection. It is undoubtedly contained in most mineral springs where carbonic acid and sulphur are present. These mineral waters, fresh from the spring, have no disagreeable odor, but in a few days smell decidedly of sulphureted hydrogen. Practical applications of the gas remain to be suggested, but it is an important scientific discovery.—*Journal of Applied Chemistry.*

Teleiconography.

Teleiconography is a long new word, which we owe to the ingenuity of our French neighbors. It means as those of our readers who are familiar with Greek will see at a glance, the drawing of distant objects. The French have a right to coin the word, inasmuch as it indicates a new and admirable method, discovered by a French artist, by which a faithful delineation of objects so distant as to require the use of the telescope to distinguish their details, may be readily and correctly effected.

M. Revoil, an architect well known in France, from having the charge of the restoration of the Roman remains at Montpellier, Toulan, Nimes, has recently been engaged in a special study of the early architecture of the southern provinces of the ancient kingdom. In the course of his attempts to arrive at exactitude of definition, by the aid at one time of the camera lucida, and at another of the telescope, he has been induced to make experiments as to the combination of the principles of the two instruments. The result of this effort M. Revoil has called the *Téléiconograph.*

The principal of this instrument is that of allowing the image transmitted by the object-glass of a telescope to pass through a prism connected with the eye-piece. The rays of light that would in the ordinary use of the telescope be transmitted direct to the eye, are refracted by this prism, and thrown down npon a table placed below the eye-piece. The distance between the prism and the table determines the size of the image projected on the latter, and it is easy for the observer to trace on a paper placed on this sketching-table, the actual outlines indicated by the refracted light.

The idea once grasped, it is easy to work out the details. The telescope is placed on a stand with screws and clamps, allowing of both horizontal and vertical motion, as it may often be necessary to give traverse to the instrument in to make a connected drawing of a larger area than can be included in the object-glass at one view. In fact, an entire panorama can be traced if the relative position of the axis of the telescope and the surface of the sketching-table are undisturbed.

We see no reason to doubt that M. Revoil's eyepiece miget be adapted to the ordinary theodolite, so that any person who possesses one of these instruments may at a small expense, obtain a good sketching apparatus.

The advantages posessed by the Teleiconograph over the camera lucida is manifest. The size of the image may be determined at will by the person who uses the former, without any diminution of accuracy. We have before us a lithograph of the summit of one of the towers of Notre Dame de Paris. The "croquis" was taken by means of the instrument of M. Revoil, at the distance of about 300 meters. It is 12 in. long. A sketch taken by the aid of a camera lucida is drawn along side, and is only one inch in length, or 1-12th part of the linear measure of the bold outline of the Teleiconogram (as we suppose the new likeness will be called). Two mountain peaks, in Province, sketched by aid of the same apparatus, show how admirably it can be applied to the sketching of country, For the purpose of military surveying, its services promise to be of the utmost value.

The Teleiconograph insures certitude in drawing, but it does not draw. It is an aid to the artist, not a self acting substitute for his eye and hand. The sharp, bold touch of a master of the art of drawing will be as distinct from the feeble peddling of an inferior workman, when the refracting prism is used, as when free-hand sketching is resorted to. The division of attention between the object and the copy, which is often so painful, will be entirely avoided by the use of this instrument. In the hands of a true artist the result will be every way admirable,—exact as a photograph, without the distortion of all those parts of the field which are distant from the centre, and at the same time marked by all the peculiarity of touch proper to the master. The camera lucida, from its greater portability, will still hold its own, but we shall hope to see M. Revoil's instrument brought into familiar use in this country, to meet circumstances for which it is peculiarly adapted. *Builder July* 17.

The deepest penetration that man has ever made into the crust of the earth is about 5000 feet, or nearly a mile. Such a depth into the earth below the ocean level has, however, never been attained. It has been estimated upon the most accurate observations that could be made, that the temperature increases at such a rate towards the centre of the earth, that at the depth of about four miles all is, with little exception, a mass of liquid fire. The proportion of the earth's crust to the molten matter within, is considered by geologists to be about the same as that of the shell of an egg to its contents.

Lighting up the Track.

Mr. Morse claims to have made several valuable discoveries and improvements in connection with the electric light. One invention claimed by him is a self-sustaining battery, and another is the device for making the carbon points, used to give the electric light, burn for months without wasting away. This electric light it is said by those who have experimented with it, will cast a shadow behind an opaque body at a distance of ten miles, but when jarred by the motion of a locomotive, the intensity of the light is diminished. The light will illumine the track three miles ahead, however, so that where the road is straight the engineer can see any object at that distance. By another ingenious device, the electricity used to run the lamps will be collected by the friction of the wheels as the trains are in motion. Two lamps will be used for lighting Bergen tunnel, with one in the middle, as the tunnel is not straight but curves. Other lamps will then be stationed at each end of the Pavonia Ferry, which will throw a broad belt of light across the North River every night to guide the traveler safely to his home in the metroplis. These lights will, it is said, be so intense that on the darkest foggy night there will be no danger of collision on the water any more than in the day-time. Still more it is proposed to fill Twenty-third street every night with a flood of white light, from the North River to the Fifth Avenue Hotel, so that travelers at the heart of the metroplis may at all times be reminded of the broad and happy way.

New Oxygen Process.

Oxygen procured cheaply and easily, is, as we have often said, a very desirable thing. The numerous applications that could be made of it are so evident that we need not stop to mention them, but we lay before our readers yet another plan, and this time an ingenious one, for obtaining it. The mineral sources of oxygen being comparatively expensive, MM. Montmagnon and Delaire have betaken themselves to that cheap reservoir, our atmosphere, and have further availed themselves of the discriminative action of wood charcoal and water, or certain saline solutions. We give here, it must be understood, the figures of the authors named, without checking them by a reference to the figures of Dr. Augus Smith, who has made most careful experiments on the absorptive action of charcoal. According, then, to our authors, 100 litres of fresh wood charcoal will, when exposed to atmospheric air, occlude 925 litres of oxygen, but only 705 litres of nitrogen. Now, it would appear that when the charcoal so saturated with gas is thoroughly saturated with water, there will be expelled 650 litres of nitrogen, but only 350 litres of oxygen. Thus we have now left in the pores of the charcoal 575 litres of oxygen, and only 45 litres of nitrogen, that is, oxygen practically pure for industrial purposes. To extract the gases, the authors employ a pump, and they tell us that if again exposed to charcoal, the oxygen will be obtained almost pure. There can be no doubt of it. They give no account of the cost of oxygen; but it is clear that it will be represented chiefly by the cost of the machinery and cost of working it.—*Mec. Mag.*

How Oroide is Made.—Oroide, the beautiful alloy resembling gold, is a French discovery, and consists of pure copper, 100 parts; zinc or (preferably) tin, 17 parts; magnesia, 6 parts; sal-ammoniac, ½ part; quicklime, 1-8 part; tartar of commerce, 9 parts. The copper is first melted, then the magnesia, sal-ammoniac, lime, and tartar in powder are added little by little, briskly stirring for about half an hour, so as to mix thoroughly; after which zinc is thrown on the surface in small grains, stirring it until entirely fused. The crucible is then covered, and the fusion maintained about thirty-five minutes, when the dross is skimmed off, and the alloy is ready for use. It can be cast, rolled, drawn, stamped, chased, beaten into a powder, or leaves; and none but excellent judges can distinguish it from gold.

Scientific Discovery.—The Master of the English Mint, Mr. Graham, has discovered that the metals palladium, platinum, and iron, have the property of absorbing a hundred, and even sometimes a thousand times their weight of gas. It appears that the gas is not merely held in the cells of the metal, but incorporated therewith, for a piece of palladium gave off no gas whatever, though inclosed for two months in an exhausted chamber. Mr. Graham lighted on his discovery while analyzing a piece of meteorite.

It is announced that a Company which has, since 1866, been boring for petroleum in Louisiana, has at last struck, not oil, but at the depth of 445 feet, a bed of sulpher, said to be 205 feet thick, of which 105 feet are the purest crystalized sulphur ever discovered. A reported analysis by a competent chemist gives 98 and 25-100ths of pure sulphur. This is a very improbable story, but it must be recollected that the same doubts were expressed during the rebellion at the discovery in Louisiana of a thick deposit of rock salt.

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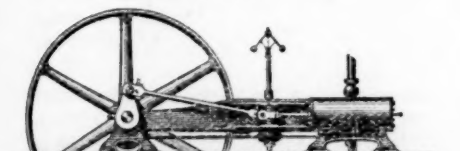

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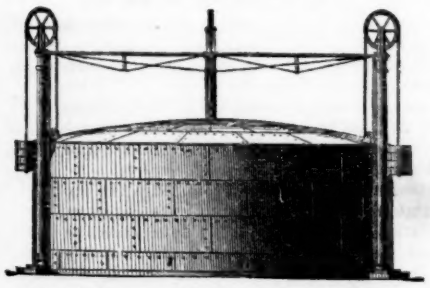

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[NOTE BY PROFESSOR WURTZ.—Contributions and items for which I am, as a Scientist, individually responsible, will have attached my full name or initials.—H. W.]

THURSDAY, SEPTEMBER 16, 1869.

WISHING TO MAKE this Journal an organ of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, the publishers solicit letters from all among them who make the study of those subjects a pleasure, or a profession.

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Answers to Correspondents.

F. E. S. of Boston; E. M. of Ironton, Ohio; R. of Terre Haute, Ind.—Communications received and will appear in our next issue, having come to hand to late for this number.

OUR REPORTS OF THE SALEM MEETING OF THE AMERICAN ASSOCIATION.

In our last two issues, we have promised such Reports. It is with pardonable pride that we call special attention to the beginning which we are now enabled to make. Other important communications are at hand, and it is our anticipation now that the substance of all the more important of the chemical papers read at the recent meeting, will be laid before our readers in the same authenticated form as those we now give. To the eminent American Scientists who have favored us with these valuable articles, we here take the opportunity to convey our gratitude, at the same time suggesting to them that they are thus introduced to a new and highly appreciative class of readers, many of whom might, otherwise have failed to be thus benefited.

It will of course be recollected that we have heretofore held out the hope that our journal might be selected by many American Scientists as a medium worthy of conveying original discoveries and memoirs to the public. We point to this issue as a justification of this hope, and as offering a bright harbinger of what may yet be brought about in this direction.

H. W.

HEATING BUILDINGS BY GAS

The following article is taken from the London *Engineer*. We have introduced it in this place because it gives much valuable information upon the subject of substituting gaseous for solid fuel, as developed and practised in Europe.

In the United States this art has lately acquired a new impulse, owing to the late discoveries and improvements in the art of manufacturing hydrogen and oxide of carbon gases, at a very trifling cost, compared to the cost of ordinary coal gas. These gases are especially adapted for heating purposes instead of solid fuel, and for use in gas engines as a substitute for steam power, and also for illuminating purposes when carburetted or charged with vapors of hydro-carbons.

The hydrogen and oxide of carbon gases are produced by the American process, under the Gwynne-Harris patent, and consists in decomposing superheated steam, by means of incandescent anthracite coal, in a peculiar manner, and in a simple yet novel apparatus.

Great improvements have also been made in the stoves and other apparatuses for heating and cooking; which overcome most if not all the difficulties heretofore experienced in this department.

The last and best improvement in this line are the Cambridge Gas Stoves, for heating and cooking; also gas furnaces, more especially designed to be substituted for coal furnaces for heating whole buildings, halls, etc.

In all these inventions, two great improvements have been made which are of the utmost importance, to all who use gas for fuel, viz., preventing any of the noxious gases of combustion entering the room, or buildings, and obtaining the greatest amount of heating and radiating surfaces possible in the smallest space and at least expense.

Physicians and invalids and all who care for comfort and health, will readily appreciate the value of such improvements as above mentioned.

In another column will be found a description of these stoves and their uses.

The use of gas as fuel has been tried to a considerable extent in France and other countries, but the progress has neither been rapid nor very satisfactory; one reason of this lies, perhaps, in the imperfection of the modes of combustion, although something has been done of late to remedy this; another is the natural hesitation of the directors of gas works to keep pressure of their gasometers all day for a small supply.

Still enough has been done to supply a certain amount of information on the economical part of the question, both as regards gas cooking apparatus and stoves for churches and other large buildings. The average consumption of the cooking stoves in use in France which consumes a mixture of gas and air is found to be as follows:—For a large fire, 260 liters per hour; for a moderate fire, 140 liters per hour; for a small fire, 50 liters per hour. When the stove is used, what the French call *pot-au-feu*, it is found that it is sufficient to keep up a large fire for about twenty minutes only, after which the gas may be turned down and the cooking completed with a very small fire. Taking the average duration of this kind of cooking at four hours, and the cost of gas at 30c. per cubic meter—the present price in Paris—the consumption amounts to 1,050.-20 liters, the expense of which is 31c. 20, or little more than 14d. The cleanliness and handiness of gas as fuel, and the great economy arising from its instantaneous lighting and extinction, give it, *in the hands of careful persons*, a great advantage over charcoal, with few of its inconveniences—one of which is the impossibility of using it for broiling with a special arrangement, as the smallest quantity of fat falling upon heated charcoal fills the house with stifling fumes.

In a coal-using country, however, like England, the use of gas for the heating of apartments, and especially large buildings like churches, is of mor eimportance than its application to cooking; and considerable improvement has been made of late in France in apparatus for the warming of ordinary rooms, to which we shall shortly have to refer more particularly.

The most important results yet produced refer to the heating of churches, which has been essayed on a large scale at Berlin. The method generally adopted is that of placing a horizontal gas-pipe with three jets within a stove made of sheet iron, and over the gas-jets a piece of brass wirework, of which the openings are not more than 1-25 of an inch in diameter. The cathedral of Berlin has a cubical contents of about 17,300 meters, and it is heated by means of 8 of these stoves, each of which has 22 of these brass gratings, 11½ in. in length by 1½ in in width, making in all about half an inch square of grating for each cubic meter to be warmed. The consumption of gas in raising the air within the edifice to the repuired tempearture—an operation which takes three hours—is 83,400 liters, or 4.82 liters per cubic meter; to maintain the same heat afterwards requires only 7-10th of a liter of gas per cubic meter.

The parish church of Berlin, whose cubic contents is 13,800 meters, is heated by four stoves, each having 15 brass gratings, each rather more than 12 in. long by 1½ in. wide, or little more than 1 5th of an inch of grating per cubic meter to be warmed. The annual consumption of gas in the cathedral above mentioned is 2.210 cubic meters, costing £20; this consumption is equal to 552 meters per stove, and 300 litters per 5-4th of an inch square of grating. The consumption in Parisian churches warmed by gas is found to agree very closely with that of the cathedral of Berlin, but other cases give different results.

The church of St. Philippe at Berlin has a contents of 2,780 meters, and is heated by two stoves 1m. 40 high, 1 m. 10 long, and 65 centimeters in width, each having seven brass gratings 16 in. by 2 in., equal to 2-5th of an inch square per cubic meter of the contents of the church. The annual consumption in this church is 1,485 cubic meters, or at the rate of 410 liters of gas per cubic meter of contents. but this church is only warmed three times a week.

The church of Saint Catherine at Hamburgh is heated by 8 gas stoves, each having 32 brass gratings, 12 in long by rather more than 1¼ inches wide; the cubic contents of the edifice is 33.900 meters. The heating takes three hours and a half, and consumes 220 meters of gas, costing about 27s. 6d., so that three liters of gas are required in this church per cubic meter of capacity; the temperature is kept up subsequently by the consumption of ¼ of a liter per cubic meter and per hour.

In the churches of St. Mary and Nicholas in Berlin, and in Paris also, a kind of large rose burner has been substituted for the brass grating; these are known in France as mushroom burners (*champigons*). The result with these burners in the first of the aboved named churches is as follows: The cubical contents of the building it 15.450 meters, and the consumption of gas in four hours is 150 cubic meters, costing about 35s., and as it is heated by ten stoves, each having three of these rose burners, the consumption per hour is 1½ cubic meters of gas per burner, and nearly 2½ meters for each meter of the contents of the church. In this case only we have the effect as shown by the thermometer, which is to raise the temperature of the church from one degree below zero to five degrees above, or from below thirty degrees to forty degrees Fah.

In heating churches and large buildings the economy of gas exhibits itself quite differently as compared with its application to cooking; in the former case, the more continuous the operation the less the relative cost, whereas in the latter the more frequent the interruptions the greater the economy. The objection to gas on account of its vitiation of the atmosphere of a building is one which neither the wire grating nor the mush room burner has yet obviated.

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The heating stoves and furnaces are provided with a double casing for a fire flue, and a central open cold air flue—both flues being provided with numerous screens as before mentioned.

The burners are at the bottom of the outside chamber or flue, and the heated air of combustion ascends to the top and descends to the bottom of the opposite side, before it enters the exit pipe or flue.

The central flue is open at top and bottom, and is also provided with screens, and the cold air is heated as it passes up through the numberless meshes of the screens, taking up nearly all the heat given out by combustion.

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THE PHILADELPHIA PHOTOGRAPHER.—The September number of this monthly has been placed upon our table. It contains four photographs of different phases of the Great Solar Eclipse, August 7th, 1869, together with a full report of the Government astronomical and photographic expedition sent to Iowa to observe and photograph the eclipse. Those who were not privileged to see the great phenomena will be much gratified by these. There are two views before, one during, and one after totality.

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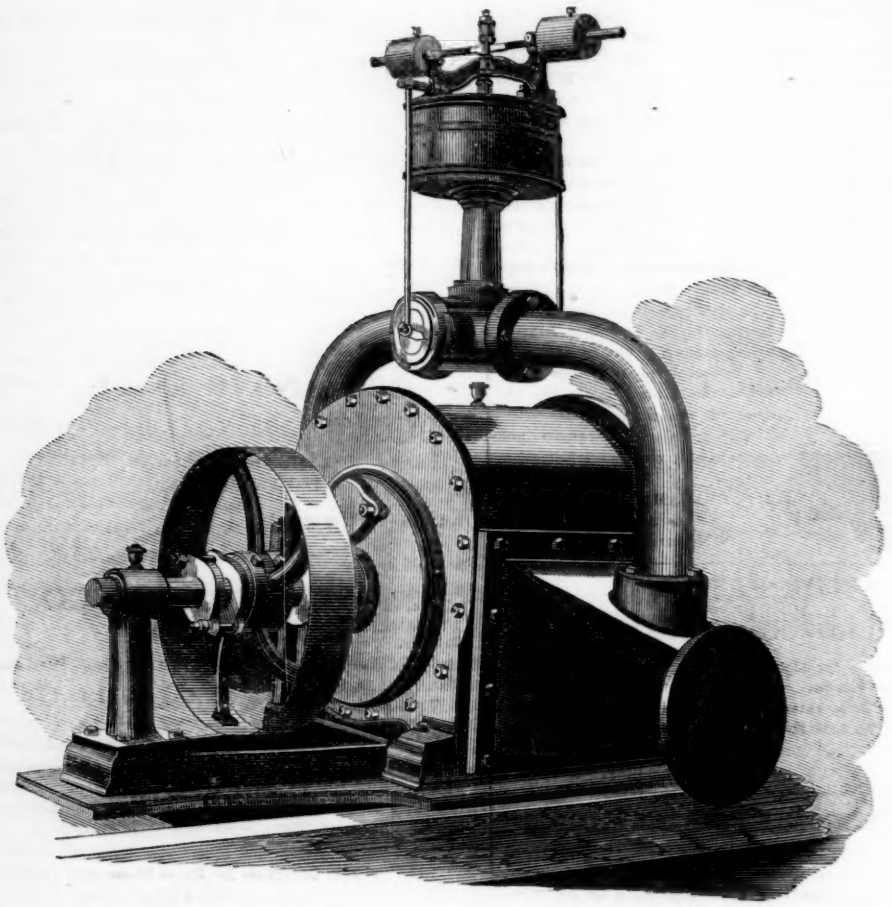

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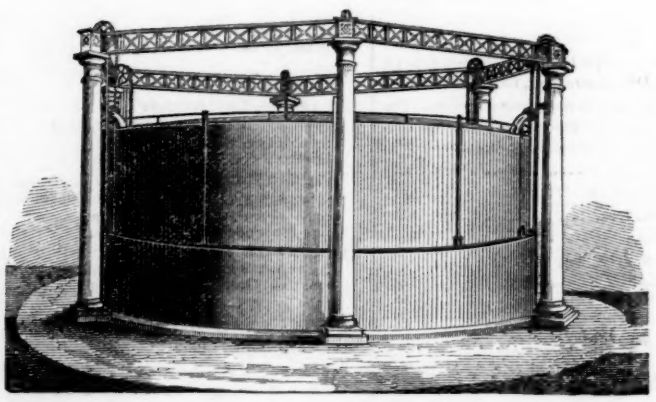

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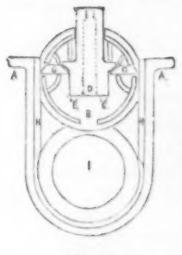

FIG. 3. FIG. 2.

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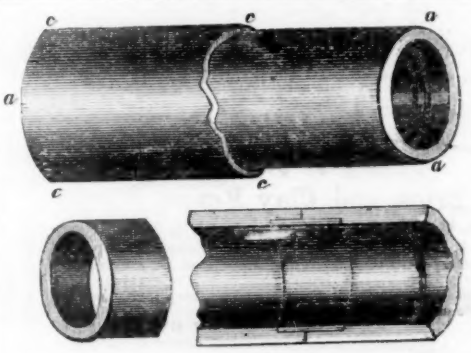

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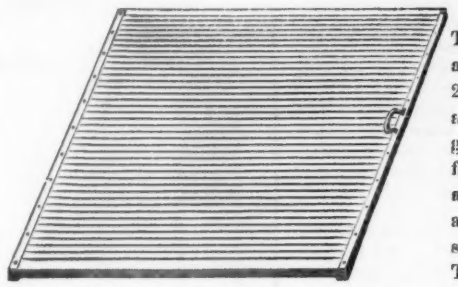

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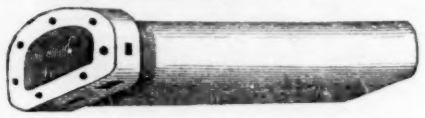

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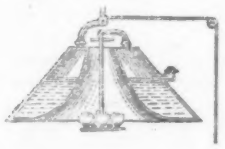

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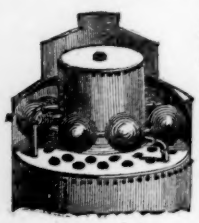

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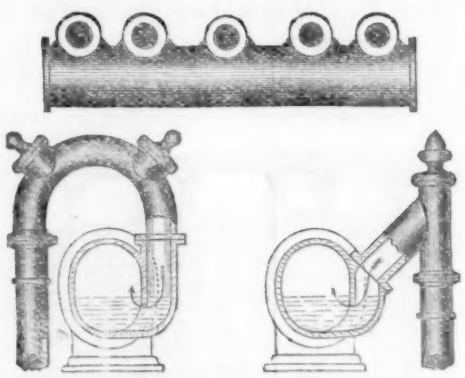

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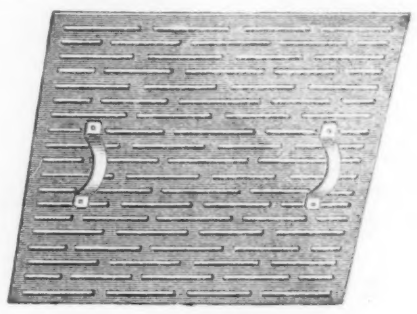

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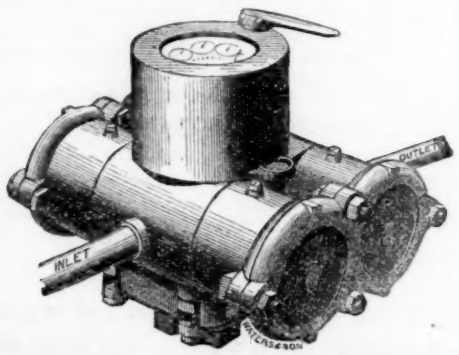

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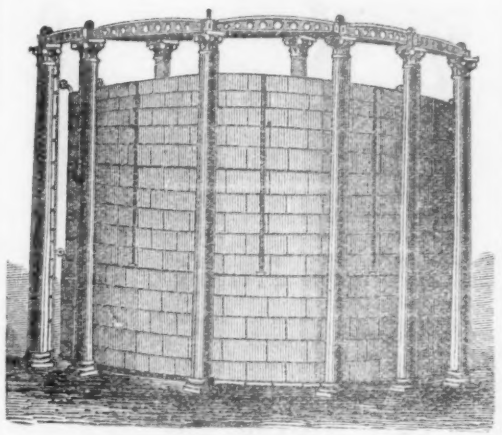

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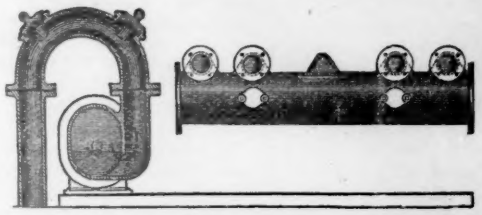

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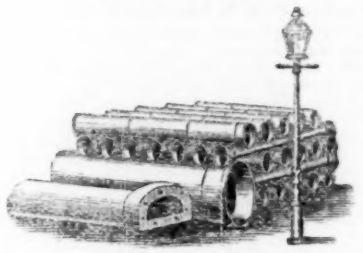

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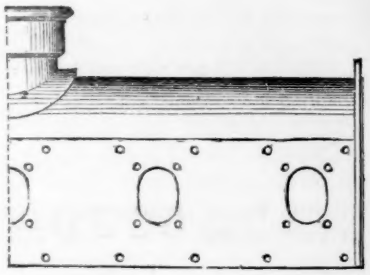

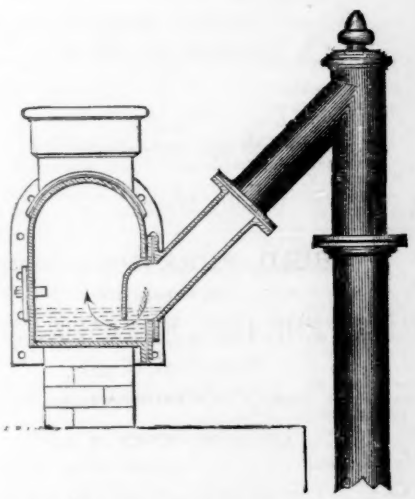

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